

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of

Amendment of Part 73 to permit Permanent Licensing
of AM Synchronous Stations

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RM No. 11779

COMMENTS OF Edward A. Schober, PE, Radiotechniques Engineering, LLC

By Edward A. Schober, PE

1. Edward A. Schober, is a licensed professional engineer employed by Radiotechniques Engineering LLC, a New Jersey limited liability company that provides engineering services to broadcasting stations. He is the applicant for a New AM station at Enola, PA, and has pending an application to acquire WKGE (AM) in Johnstown, PA. He is also a member in Winchester Radio Broadcasters, LLC, owner of WXVA(AM), Winchester, VA. He is also the licensee and permittee of several FM Translators. Mr. Schober has over thirty-seven years experience in advising broadcast radio station clients in areas of RF engineering, station design, FCC technical representation and propagation studies. Mr Schober is a member of the AFCCE, and a senior life member of the IEEE and senior member of the SBE. Mr Schober's contact information is:

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2. Mr Schober is a Full Member of the Association of Federal Communications Consulting Engineers, and supports wholeheartedly the Associations comments in this matter. These comments expand and refine the AFCCE comments based upon additional research and planning that Mr Schober has conducted, but is not yet public. The AFCCE comments are limited to dealing exclusively with the technical aspects of AM single frequency networks.

3. The FCC's record in this matter is tainted by experience of experimenters who worked with technology which was not ripe in accomplishing reliable synchronization. Experiments which took place more than 10-15 years ago should be discounted, as technology for synchronization of frequency

locking audio synchronization was immature or uneconomic. Transmission of time aligned audio has only recently been perfected over market wide distance. There are additional technologies which expand and refine the ability to build effective single frequency medium frequency networks, including overlooked ideas of the deceased inventor Leonard Kahn. Most or all of these ideas were impossible to implement during his lifetime because the technology for stable implementation did not exist. These technologies are commodity products now. Some present day commercially produced transmitters generate AM signals using hardware which could be readily reprogrammed to eliminate some of the remaining problems of self interference in medium wave single frequency networks.

4. Medium frequency single frequency networks can be readily implemented for digital broadcasting (not Hybrid IBOC) as the guard bands designed into the digital systems permit signal reinforcement from the component stations in a single frequency network for the DRM 30 system in groundwave reception, and potentially also for HD Radio digital only modes, although it is not clear whether current receivers would be able achieve signal reinforcement from multiple stations in HD Radio digital modes.

5. The major difficulty for AM radio is the gigantic increase in the ambient RF noise level from Part 15 electronic devices (and devices that purport to comply with Part 15). In many cases this increase is 20 db or more greater than compared to 40 years ago. Without changing modulation parameters, this noise can only be overcome by providing a higher desired signal level to the receiver. For many successful stations the current 50 kW limit and costs of higher power preclude any compensation of the increased noise level using present transmission facilities. The FCC, by permitting lower efficiency antennas, has opened the door to the possibility of locating a transmitter closer to the people. Low efficiency antennas generally are uneconomic except at modest power levels. Without a single frequency network, a class A station has no hope of recovering any coverage lost to noise. With a single frequency network, several lower power stations located on small plots or rooftops can combine to return noise free service to the highly populated noise polluted areas. This could be implemented with a ring of synchronized stations operating at modest power (1 – 10 kW each) using low efficiency antennas located near the high population areas that can provide strong signal levels where needed. This would be instead of a single 50 kW transmitter at one edge of the metropolitan area. It may be undesirable to configure a ‘master’ station and ‘slave’ booster stations. Mr. Schober is working on a plan to utilize two regularly licensed substantial co-channel stations to provide wide area coverage to a large rural area, filling in the weak areas with synchronous boosters. In this area Mr Schober differs from the AFCCE comments, in that the FCC should authorize both secondary boosters and primary stations as parts of single frequency networks. There are many markets where a broadcaster may acquire an additional adjacent channel full service station in a different part of the market, and seek to change the frequency be the same as its present station to be used as part of a single frequency network. This change might, in addition to change frequency, decrease power, change

antenna, etc. This task of “making one good station out of two losers” could be supplemented with secondary boosters to fill in the remaining part of the market that continues to have inadequate signal levels. Changes of this sort will reduce the net inter-station interference between stations within the market, while allowing for stronger signals over the entire market, while causing no new interference to other existing stations.

6. AM stations with directional antennas are generally located at one edge of the radio market they serve. As the radio noise level has increased, the signal levels available at the far side of the market are inadequate to provide service. A small transmitter near the population center(s) may provide a better overall signal in its vicinity, but, it is impossible with an omnidirectional or simple directional antenna to provide coverage to a reasonable portion of the market. With several lower power synchronous transmitters using simple directional antennas, or omnidirectional antennas it may be possible to serve the entire market with usable signals. An example of this is the Atlantic City-Cape May market. No AM station covers the entire market, but it would be straightforward for each of the Class C stations to operate one transmitter in the Atlantic City area in a synchronous network with another in the Cape May area and achieve full market coverage with two sites.

7. The FCC record includes the results of tests from two decades or more ago. The technology for implementing synchronous AM networks was immature until more recently than that. Frequency synchronization cost many thousands of dollars per site, and audio time alignment cost thousands more. The present state of the art permits frequency locking with GPS reference for a few hundred dollars per site, and accurate and stable audio time alignment for perhaps a thousand. Twenty years ago, this was either not possible or terribly not economic. Experimental failures that took place before the technology was adequately refined should not be held against a technology when the means to properly implement it becomes available.

8. Further improvement is available to improve the performance of AM synchronous networks. The problems of “ducking audio” on a mobile receiver even with a well designed system remain open to improvement. The use of bandlimited, subaudible phase noise modulation of the carrier(s) may alleviate the AGC pumping artifacts that remain when a mobile receiver traverses the phase cancellation pattern in the part of the service area of a synchronous network when the carrier strength of the transmitters are approximately equal.

9. The problem of “watery audio” in similar areas is likely to be alleviated, at least partially, by the use of compatible single sideband techniques where one sideband is modified compared to the other. When an envelope detector in a receiver detects a signal with two locked double sideband synchronous transmissions, the phase of the audio in each of the two resultant summed sidebands will not properly align, disrupting the proper decoding of the signal. This causes a “watery” distortion of the audio that

is a function of the envelope detector. Without Software Defined Radio transmitters, it was uneconomic to implement efforts to unbalance and pre-distort the signal. Mr. Schober is currently refurbishing a pair of 10 kW AM transmitters to include a Software Defined Radio exciter which will be able to fully implement and experiment with the parameters of this technology.

10. Night operation of AM wide area semi-synchronous ad-hoc networks has considerable value. Many AM stations broadcast the same basic syndicated and network programming at night, particularly late at night when disruptive skywave interference is at its greatest. Frequency locking, with or without phase modulated subaudible noise will provide a measure of protection from other co-channel beat interference by itself. If the network programs were to be locked the amount of mutual interference between stations so locked would reduce by six or more decibels. If the program time displacement were either locked or offset by 20 to 40 milliseconds, the formerly “interfering signal” would be perceived as “reverb” instead of interference. The local commercials and station produced content would have no benefit of the time alignment, but would still receive the benefit of the decrease in beat interference from other cooperating stations. Formally recognizing the reduction in co-channel night interference from cooperating stations (no longer ad-hoc) could potentially benefit in allowing a more generous “night limit” calculations for determining service area the station service area based upon a protection ratio of 18 db in lieu of a 26 db, for the interference contribution between cooperating stations.

11. The proposal before the Commission is to authorize synchronous medium wave networks as regularly authorized systems. Mr. Schober is in complete agreement with this premise. He believes however that semi-synchronous networks are also beneficial and should be the subject of further experimentation. The situation where a synchronous network extends over an entire metropolitan area it may make sense to break audio synchrony at times when, for example, traffic reports are made, as traffic reports can be much shorter and more succinct and appropriate to the listeners. When each member of the synchronous network presents only the salient traffic information for its portion of the service area there are big gains. An example, in the Atlantic City - Cape May market: Summertime traffic information for Atlantic City area and Cape May areas are only important near the respective transmitting member of the synchronous network. For the 30 seconds or so that Cape May traffic is presented, the other member in the Atlantic City area would simultaneously present its own local traffic. The network would re-establish audio synchrony for the Garden State Parkway traffic of interest to both areas. A properly designed network would, during the audio non-synchronous period simply sound as if two people were talking at once in the area where the two transmitters have similar field strength, such as at Strathmere and Woodbine where neither Cape May nor Atlantic City traffic is of interest. In areas where the signals are unequal, such as Ocean City and Avalon, it would sound as someone were speaking in the background for the traffic information that one might possibly be interested in, and where one signal is strong, Such as Pleasantville or Wildwood the other signal would

not be heard and the traffic information for the area of interest would be delivered without impediment.

12. The FCC has expressed concern that its policies not provide free licenses to parties without participating in the auction process or other equitable methods of distributing licenses under the Communications Act. Unfortunately, due to the inadequacy of the Part 15 Rules to protect AM and other users of the Medium Frequency Bands from interference from the plethora of RF noise generators the AM noise floor has risen precipitously. All AM stations have lost most of their service area due to this noise, and as such any reasonable measures to restore lost coverage is simply the return of some of the previous service area. Mr. Schober is one of very few parties that continue to pursue a new AM facility from the 2004 AM auction window. Suffice it to say that there is nearly no demand for new AM service within the United States. To the extent that no new interference is caused to existing stations, there can be no doubt that regularly authorizing Single Frequency Networks as a modest measure to combat the loss of service area by existing AM stations is a measure that is in the public interest.

13. Full digital transmissions of Medium Wave synchronous networks are capable of being engineered so that there is virtually no mutual interference in a well designed network. The fully digital versions of HD Radio medium wave systems have adequate guard times to make a local synchronous network fully compatible. The DRM¹30 system provides even greater guard bands, and utilizes more forgiving design constraints in implementing a synchronous medium wave network, as it has been designed with synchronous networks in mind. Fully synchronized DRM30 has also been extended for high performance in multi-transmitter single frequency networks to utilize Cyclic Delay Diversity that nearly eliminates degradation due to the channel frequency response disruption from the use of multiple transmitters in an Single Frequency Network².

14. In summary, Mr. Schober has presented a case that the Federal Communications Commission should:

- Regularly license both secondary booster stations and multiple full service stations as members of single frequency networks.
- Authorize single frequency networks to operate using new technologies, such as bandlimited noise phase modulation, “compatible single sideband”, vestigial sideband, modified double

1 *Utilization of the MF Band for Providing Digital Radio Services for Greece*, Anastasios Papatsoris, Dimitris Varsamis

https://www.researchgate.net/publication/281063053_Utilization_of_the_MF_band_for_Providing_Digital_Radio_Services_in_Greece

2 *Study of Cyclic Delay Diversity for Single Frequency Network using DRM Standard*, Vincent Savaux, et al.

https://www.researchgate.net/publication/260727160_Study_of_Cyclic_Delay_Diversity_for_Single_Frequency_Network_using_DRM_Standard

sideband and other technologies that have not yet had adequate research conducted to be fully developed.

- Recognize the benefits of semi-synchronous night operation when multiple co-channel stations program the same network programming overnight.
- Exclude out of date experimental data gathered before the technology was mature for stabilizing frequency and audio alignment.
- Recognize that increases in coverage of existing stations by implementing secondary boosters and frequency changes to convert an adjacent channel station to become a member of a single frequency network.
- Consider that AM stations in a single frequency network within a market should be considered as a single AM station for fees, reporting, multiple ownership, studio, call sign and other purposes.
- Recognize that full digital operation using Non-Hybrid modes of HD Radio, and DRM30 digital systems is fully compatible with single frequency networks.

Respectfully Submitted,

A handwritten signature in blue ink that reads "Edward A. Schober". The signature is written in a cursive, flowing style.

Edward A. Schober, PE
29 December 2016